HLWYM HEmails

From: Timothy McCartin
Sent: Wednesday, March 30, 2005 1:45 PM
To: bhill@cnwra.swri.edu; Donald Hooper; Gary Walter; Paul Bertetti; Patrick Laplante; Roland Benke; rnes@cnwra.swri.edu; Sitakanta Mohanty; John Trapp; Keith Compton; Michael Waters
Cc: Bret Leslie; Tina Ghosh
Subject: Re: ICRP inhalation dose coefficient selection for the directreleasescenario in the TPA code, particle

Roland:

Your reasoning seems sound to me.

Tim

>>> Roland Benke <rbenke@cnwra.swri.edu> 03/30/05 12:34PM >>>

Background

ICRP72 inhalation dose coefficients are based on the newer ICRP respiratory tract model, described in ICRP Publication 66 (ICRP66). The LUDEP computer code, licensed from the UK, applies the ICRP66 respiratory tract model and was used by the ICRP during the development of the ICRP72 dose coefficients..
While the LUDEP code allows for detailed investigations into the calculations of the ICRP dose coefficients, it does not include the updated biokinetic models for some radionuclides (e.g., updated biokinetic models for Pu and Am are described in ICRP Publications 67 and 71 and supercede the older ICRP30 biokinetic models) and, therefore, the LUDEP code alone cannot recompute the ICRP72 inhalation dose coefficients. The updated biokinetic models tend to have a relatively small effect on the dose coefficients, which typically differ by less than about 50% compared to dose coefficients when the older biokinetic model is paired with the newer repiratory tract model. This small difference meant that the LUDEP code could be used to gain meaningful insights on the dependence of the inhalation dose coefficient to other factors, such as particle size distribution and receptor physical-activity & breathing levels.

ICRP uses lognormal particle size distributions for its dose coefficients to the public and workers. For public environmental exposure, an Activity Median Aerodynamic Diameter of 1 micron is used with a geometric standard deviation of 2.47. For workplace exposure, an Activity Median Aerodynamic Diameter of 5 microns is used with a geometric standard deviation of 2.5.
Since the two standard particle size distributions may not adequately cover the wide range of potential exposure scenarios and specific aerosol conditions, ICRP published supplemental inhalation dose coefficients in 2002 for several Activity Median Aerodynamic Diameters that ranged from 1 nm to 10 microns.

Proposal

To account for particle size considerations, it is recommended that the ICRP inhalation dose coefficients for an Activity Median Aerodynamic Diameter
(AMAD) of 10 microns be used in the TPA code for the direct release scenario.

Basis

CNWRA airborne mass load measurements over the Cerro Negro tephra deposit
indicate: (i) heavy disturbance, such as driving over the deposit, produced airborne mass loads where about 95% of the measured airborne particle mass was associated with the particle sizes > 10 microns and (ii) light disturbance, such as walking over the deposit, produced airborne mass loads where about 60% of the

measured airborne particle mass was associated with the particle sizes > 10 microns (Hill, B.E., C.B. Connor, J. Weldy, N.
Franklin. 2000. Methods for Quantifying Hazards from Basaltic Tephra-Fall Eruptions. Proceedings of the Cities on Volcanoes 2 Conference, Auckland, New Zealand, February 12-14, 2001).

The AMAD is a median quantity that defines the aerodynamic diameter of a distribution of particle sizes where 50% of the airborne activity is associated with particle sizes greater than the AMAD and 50% of the airborne activity is associated with particle sizes less than the AMAD. A 10-micron AMAD appears reasonable for the mass loading from light disturbance and a bit cautious for the mass loading from heavy disturbance. More detailed assessments using insights from the LUDEP code suggest that use of the single particle size distribution with a 10-micron AMAD, as better representation the particle size distribution for the direct release scenario than the default 1-micron AMAD, would not lead to underestimations of the inhalation dose. Overall, the shift from the default 1-micron AMAD in favor of a 10-micron AMAD will generally reduce the ICRP inhalation dose coefficients by about a factor of 2 for the key radionuclides.

Roland

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Subject: Re: ICRP inhalation dose coefficient selection for the directreleasescenario in the TPA code, particle
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From: Timothy McCartin

Created By: Timothy.McCartin@nrc.gov

Recipients:
"Bret Leslie" <Bret.Leslie@nrc.gov>
Tracking Status: None
"Tina Ghosh" <Tina.Ghosh@nrc.gov>
Tracking Status: None
"bhill@cnwra.swri.edu" <bhill@cnwra.swri.edu>
Tracking Status: None
"Donald Hooper" <dhooper@cnwra.swri.edu>
Tracking Status: None
"Gary Walter" <gwalter@cnwra.swri.edu>
Tracking Status: None
"Paul Bertetti" <pbertetti@cnwra.swri.edu>
Tracking Status: None
"Patrick Laplante" <plaplante@cnwra.swri.edu>
Tracking Status: None
"Roland Benke" <rbenke@cnwra.swri.edu>
Tracking Status: None
"rnes@cnwra.swri.edu" <rnes@cnwra.swri.edu>
Tracking Status: None
"Sitakanta Mohanty" <smohanty@cnwra.swri.edu>
Tracking Status: None
"John Trapp" <JST@nrc.gov>
Tracking Status: None
"Keith Compton" <Keith.Compton@nrc.gov>
Tracking Status: None
"Michael Waters" <Michael.Waters@nrc.gov>
Tracking Status: None

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